

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

REC'D 14 OCT 2005

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Applicant's or agent's file reference ---	FOR FURTHER ACTION		See Form PCT/IPEA/416
International application No. PCT/PL2004/000054	International filing date (day/month/year) 09.07.2004	Priority date (day/month/year) 11.07.2003	
International Patent Classification (IPC) or national classification and IPC B64C9/20, B64C9/16			
Applicant INSTYTUT LOTNICTWA et al			

1. This report is the International preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
 - a. ☒ sent to the applicant and to the International Bureau) a total of 4 sheets, as follows:
 - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
 - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
 - b. ☐ (sent to the International Bureau only) a total of (Indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

- ☒ Box No. I Basis of the opinion
- ☐ Box No. II Priority
- ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and Industrial applicability
- ☐ Box No. IV Lack of unity of invention
- ☒ Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or Industrial applicability; citations and explanations supporting such statement
- ☐ Box No. VI Certain documents cited
- ☐ Box No. VII Certain defects in the international application
- ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 03.05.2005	Date of completion of this report 14.10.2005
Name and mailing address of the International preliminary examining authority:  European Patent Office - P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Tx: 31 651 epo nl Fax: +31 70 340 - 3016	Authorized Officer Estrela y Calpe, J Telephone No. +31 70 340-2689



**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/PL2004/000054

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.
- ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
- ☐ international search (under Rules 12.3 and 23.1(b))
 - ☐ publication of the international application (under Rule 12.4)
 - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)
2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-3 received on 03.05.2005 with letter of 29.04.2005

Claims, Numbers

1, 2 received on 03.05.2005 with letter of 29.04.2005

Drawings, Sheets

1/6-6/6 as originally filed

- ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing
3. ☐ The amendments have resulted in the cancellation of:
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):
4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
- ☐ the description, pages
 - ☐ the claims, Nos.
 - ☐ the drawings, sheets/figs
 - ☐ the sequence listing (*specify*):
 - ☐ any table(s) related to sequence listing (*specify*):

* If item 4 applies, some or all of these sheets may be marked "superseded."

**INTERNATIONAL PRELIMINARY REPORT
ON PATENTABILITY**

International application No.
PCT/PL2004/000054

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes: Claims	2
	No: Claims	1
Inventive step (IS)	Yes: Claims	
	No: Claims	1, 2
Industrial applicability (IA)	Yes: Claims	1, 2
	No: Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

**Reasoned statement with regard to novelty, inventive step or industrial applicability;
citations and explanations supporting such statement**

1. Reference is made to the following document:

D1: DE 748 146 C (JOSEPH KSOLL) 27 October 1944 (1944-10-27)

2. The present application does not meet the criteria of Article 33(1) PCT, because the subject-matter of **independent claim 1** is not new in the sense of Article 33(2) PCT.
- 2.1. The document D1 discloses (see figures 1a-1c and 6; page 2, line 35 to 75 and page 3, lines 4-8; the references in parentheses applying to this document):

Wing (I) of aircraft with slats and segmented one-slotted sliding flaps consisting of placed in wing chamber two movable segments: fore box (III) and main flap (II) connected by spring actuators (10) to each other and moving on rolls (4) along curved guides (1) this way, that fore box (III) is situated in each of its positions at least partially within the chamber (IV), and the main flap (II) is situated in its various positions at least partially within the chamber (IV) or fully beyond it (see figures 1b and 1c), whereby that wing chamber (IV) composes a sector of cylinder ring with thickness limited by both a tangent to wing box (I) surface at its top rear point and closing panel (see wing part at the bottom of chamber IV), situated at the bottom of this box (I), and fore box (III) has got outline with both upper and bottom lines strictly fitting to shape of chamber (IV), at the same time from aft spar of wing direction this outline is open so, that it comprises elements (1, 2, 3, 6, 9, 10,...) of driving gear of flap, whereas guides (1), built as single C-shaped rails and immovably attached to wing, are formed by means forcing mutual position of fore box (III) and main flap (II) in each phase of their movement, in such a way, that during protruding of the wing flap, increase of both extension and camber of the wing airfoil follows in continuous way, and rear wall of fore box (III) composes with attack surface of main flap (II) a continuously changing slot (see figure 1c), convergent in aft edge of wing direction.

3. **Dependent claim 2** does not contain any features which, in combination with the features of any claim to which it refers, meet the requirements of the PCT in respect of inventive step.
- 3.1. Document D1 also shows that radius (R) of curvature of guides (1) is bigger than a half chord (c) of wing airfoil section. The feature that this *radius of curvature considerably decreases on the end of the guide* would be regarded by the skilled person as a normal design option.

4. **CONCLUSION.**

Claims 1 and 2 do not meet the requirements of Articles 33 (2) and (3) PCT.

Wing of aircraft

Subject matter of an invention is wing of aircraft with slats and segmented one-slotted sliding flaps with driving gear.

5 The wing of such type, for example from patent description DE 748146, has got a flap, which consists of placed in wing chamber two movable segments. They are set on movable guides composing an unit of rails, driven by toothed wheels. The segments shift to the back, causing increase of wing airfoil extension. At terminal position one of the segments closes a rear outlet of the chamber and the second one – fixed rotationally
10 to guide and completely protruded beyond the chamber – incline downwards forming a slot between the segments. A dimension of the slot is defined by length of cable, supporting the rotated segment.

According to the invention wing of aircraft with slats and segmented one-slotted sliding flaps consisting of placed in wing chamber two movable segments: fore box and
15 main flap connected by spring actuators to each other and moving on rolls along curved guides this way, that fore box is situated in each of its positions at least partially within the chamber, and the main flap is situated in its various positions at least partially within the chamber or fully beyond it, is characterized in that wing chamber composes a sector of cylinder ring with thickness limited by both a tangent to wing box surface at its top
20 rear point and closing panel, situated at the bottom of this box, and fore box has got outline with both upper and bottom lines strictly fitting to shape of chamber. From aft spar of wing direction this outline is open so, that it comprises elements of driving gear of flap. The guides, built as single C-shaped rails and immovably attached to wing, are formed by means forcing mutual position of fore box and main flap in each phase of
25 their movement, in such a way, that during protruding of the wing flap, increase of both extension and camber of the wing airfoil follows in continuous way, and rear wall of fore box composes with attack surface of main flap a continuously changing slot, convergent in aft edge of wing direction. Radius of curvature of guides is bigger than a half chord of wing airfoil section and considerably decreases on their end.

30 Driving gear of each flap is located along wing span and completely hidden in transversal outline of the wing.

A solution according to the invention brings profitable effects, increasing wing lift throughout three phases of flight – take-off, cruising and landing of aircraft. At
35 cruising phase, in range of small angles of flap displacement, it affords possibilities for un-slotted increase of wing airfoil camber. At both take-off and landing phases an increase of flap displacement with simultaneous extension of wing airfoil allows to obtain optimal airfoil with slotted flow in these conditions, preventing premature flow separation on upper wall of an airfoil. For each phase of flight, also owing to panel closing chamber, there is decreased flow drag on bottom wall of an airfoil.

40 As opposed to prior art, the solution according to the invention is characterized by smooth change of both camber and extension of the wing airfoil and also smooth change of slot dimension. It gives following potentialities:

- at cruise configuration of wing airfoil (both camber and extension without
45 slot) there is possible the change of aerodynamic angle of attack of wing in relation to fuselage according to current mass of aircraft, what minimises aerodynamic drag of aircraft in given conditions. At high cruise speed the change of both camber and extension of rear part of wing airfoil, modifying pressure distribution on airfoil, makes possible a mitigation of shock wave crisis occurrence on the wing:

- at take-off configuration of wing airfoil (both camber and extension with slot) there is possible to obtain optimal lift coefficient of wing and optimal lift/drag ratio of aircraft, which has an effect on increase of second segment of aircraft climb gradient and on decrease of BFL factor (take-off Balanced Field Length according to FAR 25 definition);
- at landing configuration of wing airfoil (both camber and extension with slot) there is possible both to obtain large lift coefficients, which have direct influence on landing speed and to reduce lift/drag ratio of aircraft in order to attain steeper glide path of aircraft on landing.

A location of elements of wing flap driving gear within the outline of fore box enables an application of this solution for wings of various airfoil shapes, and fastening of guides immovably simplifies highly their structure.

- A location of driving gear of each wing flap along wing span so, that it is completely hidden in transversal outline of the wing, leads to a decrease of wing drag, and as a consequence whole aircraft, of about 1.5 %.

A wing of aircraft may be equipped, along span of trailing edge, with greater number of flaps (e.g. over a dozen). It allows to obtain following utility characteristics of wing:

- high coefficient of lift,
- optimal distribution of both circulation and lift along span, according to flight phase, due to an analysis of both induced drag and weight of structure,
- elimination of conventional lateral control in form of ailerons or flaperons.

The object of the invention is shown as exemplary embodiment in drawing, in which fig.1 presents wing airfoil section according to the invention, with indication of both guides radius and airfoil chord, and following figures present the same airfoil section: fig.2 – in cruising phase for smooth configuration, fig.3 – in cruising phase for increased camber configuration, fig.4 – in take-off phase, fig.5 – in landing phase, while fig.6 presents segment of wing, according to the invention, with built in driving gear, at top view, in cruising phase, fig.7 – cross section of this segment, fig.8 – the same segment at top view, in landing phase, fig.9 – cross section of this segment, fig.10 presents driving gear of flap with its main components, at top half-view, fig.11 – section of this gear marked as A-A on fig.10, and fig.12 – section of this gear marked as B-B on fig.10.

Wing of aircraft is equipped with slats 1 and segmented sliding flaps. Two movable segments in each flap: fore box 2 and main flap 3, are connected by spring actuators 4 to each other. The segments move on rolls 5 along guides 6 built as single C-shaped rails and immovably attached to wing. Radius R of curvature of guides is bigger than a half chord c of wing airfoil section and considerably decreases on their end. The segments are located in chamber 7, which composes a sector of cylinder ring with thickness limited by both a tangent to wing box 8 surface at its top rear point and closing panel 9 situated at the bottom of this box. The fore box 2 has got outline with both upper and bottom lines strictly fitting to shape of chamber 7. From aft spar of wing direction this outline is open so, that it comprises elements of driving gear of flap.

The driving gear of each flap is located along wing span and completely hidden in transversal outline of the wing. It is fixed on rear plane 10 of wing box 8, perpendicular to airfoil section chord c .

Main flap 3 is moved forward by pusher 11, connected on one end with flap ferrule 12, and on other one with trolley 13 sliding along guide 14 on screw 15 powered

through Cardan joint 16. by hydraulic engine 17 with transmission gear 18. A motion of fore box 2 results from its connection with main flap 3 by spring actuators 4.

- 5 During an aircraft cruising phase the solution according to the invention gives possibility to move main flap 3 forward so. that the wing airfoil both cambers slightly and extends a little: at the same time fore box 2 is totally situated within chamber 7. and the main flap remains at partial contact with the chamber. During aircraft take-off and landing phases main flap 3 goes fully protruded beyond chamber 7; at the same time fore box 2 partially contacts with the chamber. During protruding of the wing flap
10 increase of both extension and camber of the wing airfoil. owing to suitable shaping of guides 6. follows in continuous way. and rear wall of fore box 2 composes with attack surface of main flap 3 a continuously changing slot. convergent in aft edge of wing direction.

AMENDED CLAIMS

[received by the International Bureau 28 December 2004 (28.12.04);
original claims 1 and 2 replaced by new claims 1 and 2 (1 page)]

1. Wing of aircraft with slats and segmented one-slotted sliding flaps consisting of placed in wing chamber two movable segments: fore box and main flap connected by spring actuators to each other and moving on rolls along curved guides this way, that fore box is situated in each of its positions at least partially within the chamber, and the main flap is situated in its various positions at least partially within the chamber or fully beyond it, characterized in that wing chamber (7) composes a sector of cylinder ring with thickness limited by both a tangent to wing box (8) surface at its top rear point and closing panel (9), situated at the bottom of this box, and fore box (2) has got outline with both upper and bottom lines strictly fitting to shape of chamber (7), at the same time from aft spar of wing direction this outline is open so, that it comprises elements of driving gear of flap, whereas guides (6), built as single C-shaped rails and immovably attached to wing, are formed by means forcing mutual position of fore box (2) and main flap (3) in each phase of their movement, in such a way, that during protruding of the wing flap, increase of both extension and camber of the wing airfoil follows in continuous way, and rear wall of fore box (2) composes with attack surface of main flap (3) a continuously changing slot, convergent in aft edge of wing direction.
2. Wing of aircraft as claimed in Claim 1, characterized in that radius (R) of curvature of guides (6) is bigger than a half chord (c) of wing airfoil section and considerably decreases on their end.